

AMENDMENTS IN THE CLAIMS

Pursuant to the Notice set forth in the February 25, 2003, Official Gazette (No. 1267-4) and in accordance with the procedure set forth therein, the following amendment includes a marked-up complete listing of amended claims. This complete listing includes cumulative amendments made through the present submission.

Please amend claims 1, 3, 4, and 5 as follows, and enter new claims 8-15:

1. (Currently amended) A lens barrel comprising:

a front sub-lens group provided on the object side and a rear sub-lens group provided on the image side, said front and rear sub-lens groups functioning optically when in a mutually close position and in a mutually distant position with respect to the optical axes of said front and rear sub-lens groups;

a front sub-lens group frame for supporting said front sub-lens group and a rear sub-lens group frame for supporting said rear sub-lens group, ~~said front and rear sub-lens group frames being held in engagement with each other while being able to move in the optical axis direction relative to each other;~~

a lens frame shift mechanism for causing said front sub-lens group frame and said rear sub-lens group frame to move relative to each other to obtain said mutually close position and said mutually distant position;

a first lens group positioning surface, provided on said front sub-lens group frame, for positioning said front sub-lens group in the optical axis direction by contacting a portion of a rear surface of said front sub-lens group upon said front sub-lens group being inserted from the front side of said front sub-lens group frame; and

a front frame engaging portion provided on a rear side of said front sub-lens group frame,

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a second lens group positioning surface, provided on said rear sub-lens group frame, for positioning said rear sub-lens group in the optical axis direction by contacting a portion of a front surface of said rear sub-lens group upon said rear sub-lens group being inserted from the rear side of said rear sub-lens group frame; and

a rear frame engaging portion provided on a front side of said rear sub-lens group frame,

wherein said front frame engaging portion is held in engagement with said rear frame engaging portion in the direction of the optical axis while said front and rear sub-lens group frames are able to move in the optical axis direction relative to each other.

2. (Original) The lens barrel according to claim 1, wherein said front sub-lens group frame includes a front sealed region in the front end portion thereof, said front sealed region preventing said front sub-lens group from coming out from the front side of said front sub-lens group frame; and

wherein said rear sub-lens group frame includes a rear sealed region in the rear end portion thereof, said rear sealed region preventing said rear sub-lens group from coming out from the rear side of said ~~front~~ rear sub-lens group frame.

3. (Currently amended) The lens barrel according to claim 1, further comprising:

a pair of follower engaging recesses which are formed on one of ~~opposing surfaces~~ said front frame engaging portion of said front sub-lens group frame and said rear frame engaging portion of said rear sub-lens group frame; and

a follower projection ~~which are~~ formed on the ~~other~~ remaining one of said ~~opposing surfaces~~ said front frame engaging portion of said front sub-lens group frame and said rear frame engaging portion of said rear sub-lens group frame;

wherein said mutually close position of said front sub-lens group is defined via

engagement of said follower projection and one of said pair of follower engaging recesses, and said mutually distant position of said front sub-lens group is defined via engagement of said follower projection and the other of said pair of follower engaging recesses.

4. (Currently amended) The lens barrel according to claim 1, wherein said front sub-lens group frame and said rear sub-lens group frame can be rotated relative to each other; and wherein said lens frame shift mechanism includes a shift cam mechanism provided on ~~opposing surfaces~~ said front frame engaging portion of said front sub-lens group frame and said rear frame engaging portion of said rear sub-lens group frame for moving said front and rear sub-lens group frames to said mutually distant position and to said mutually close position in accordance with the relative rotation of said front and rear sub-lens group frames.

5. (Currently amended) The lens barrel according to claim 4, wherein said shift cam mechanism includes:

a shift cam surface provided on one of the ~~opposing surfaces~~ front frame engaging portion of said front sub-lens group frame and said rear frame engaging portion of said rear sub-lens group frame, said shift cam surface being inclined with respect to a circumferential direction thereof; and

a follower projection provided on the ~~other~~ remaining one of said ~~opposing surfaces~~ front frame engaging portion of said front sub-lens group frame and said rear frame engaging portion of said rear sub-lens group frame for engaging with said shift cam surface.

6. (Original)The lens barrel according to claim 5, wherein a pair of follower engaging recesses are formed at opposite ends of each of said shift cam surfaces, wherein said follower projection engages with one of said follower engaging recesses when said front and rear sub-lens group frames are in said mutually close position and in said mutually distant position.

7. (Original) The lens barrel according to claim 1, wherein said front and rear sub-lens groups form one of a plurality of variable lens groups of a zoom lens system that are moved in the optical axis direction during zooming, said front and rear sub-lens groups serving as a focusing lens group when in said mutually close position and in said mutually distant position; and

wherein said lens barrel includes a focusing mechanism for moving said front and rear sub-lens group frames in said mutually close position and in said mutually distant position, in the optical axis direction, while maintaining a constant distance between said front and rear sub-lens group frames.

8. (New) A lens barrel comprising:

a front sub-lens group frame that mounts a front sub-lens group, and including a front sub-lens group positioning surface facing forward that contacts a rear surface of the front sub-lens group upon insertion thereof;

a rear sub-lens group frame that mounts a rear sub-lens group, and including a rear sub-lens group positioning surface facing rearward that contacts a front surface of the rear sub-lens group upon insertion thereof;

said front and rear sub-lens group frames moving relative to each other in the optical axis direction between a mutually close determined distance and a mutually distant determined distance, and being held in direct engagement in the optical axis direction during such movement,

wherein an accumulated deviation in said mutually close determined distance and said mutually distant determined distance includes only deviations of (i) said front sub-lens group positioning surface, (ii) said rear sub-lens group positioning surface and (iii) said direct engagement of said front and rear sub-lens group frames.

9. (New) The lens barrel according to claim 8, wherein said front sub-lens group frame includes a front sealed region in the front end portion thereof, said front sealed region sealing the front sub-lens group in said front sub-lens group frame; and

wherein said rear sub-lens group frame includes a rear sealed region in the rear end portion thereof, said rear sealed region sealing the rear sub-lens group in said rear sub-lens group frame.

10. (New) The lens barrel according to claim 8, said direct engagement being between respective opposing surfaces of said front sub-lens group frame and said rear sub-lens group frame, the lens barrel further comprising:

a pair of follower engaging recesses formed on one of said opposing surfaces; and

at least one follower projection formed on the remaining one of the opposing surfaces;

wherein said mutually close determined distance is defined via engagement of said follower projection and one of said pair of follower engaging recesses, and said mutually distant determined distance is defined via engagement of said follower projection and the remaining one of said pair of follower engaging recesses.

11. (New) The lens barrel according to claim 8, wherein said front sub-lens group frame and said rear sub-lens group frame are rotatable relative to each other; and

wherein said lens frame shift mechanism includes a shift cam mechanism, provided to said respective opposing surfaces of said front sub-lens group frame and said rear sub-lens group frame, that moves said front and rear sub-lens group frames between said mutually distant determined distance and said mutually close determined distance in accordance with relative rotation of said front and rear sub-lens group frames.

12. (New) The lens barrel according to claim 11, wherein said shift cam mechanism

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includes:

a shift cam surface provided on one of said respective opposing surfaces, said shift cam surface being inclined with respect to a circumferential direction thereof; and

a follower projection provided on the remaining one of said respective opposing surfaces, engaging with said shift cam surface.

13. (New) The lens barrel according to claim 12, wherein a pair of follower engaging recesses are formed at opposite ends of each of said shift cam surfaces, wherein said follower projection engages with one of said follower engaging recesses when said front and rear sub-lens group frames are at said mutually close determined distance and in said mutually distant determined distance.

14. (New) The lens barrel according to claim 8, further comprising:

a lens frame shift mechanism for causing said front sub-lens group frame and said rear sub-lens group frame to move relative to each other between said mutually close determined distance and said mutually distant determined distance; and

a focusing mechanism for moving said front and rear sub-lens group frames together in the optical axis direction, while maintaining one of said mutually close determined distance and in said mutually distant determined distance.

15. (New) The lens barrel according to claim 8, wherein said front and rear sub-lens groups form one of a plurality of variable lens groups of a zoom lens system that are moved in the optical axis direction during zooming, said front and rear sub-lens groups serving as a focusing lens group when at said mutually close determined distance and at said mutually distant determined distance.

16. (New) A lens barrel comprising:

a front sub-lens group frame that mounts a front sub-lens group, and including a front sub-lens group positioning surface facing forward that contacts a rear surface of the front sub-lens group upon insertion thereof;

a rear sub-lens group frame that mounts a rear sub-lens group, and including a rear sub-lens group positioning surface facing rearward that contacts a front surface of the rear sub-lens group upon insertion thereof;

said front sub-lens group frame directly engaging said rear sub-lens group frame in the optical axis direction, so that there is only one direct engagement in the optical axis direction between said front sub-lens group positioning surface and said rear sub-lens group positioning surface, and the accumulation of deviation in a determined distance between said front sub-lens group positioning surface and said rear sub-lens group positioning surface is thereby reduced,

wherein said front sub-lens group frame and said rear sub-lens group frame move relative to each other in the optical axis direction and are held in said direct engagement during such movement.

17. (New) The lens barrel according to claim 16, wherein said front sub-lens group frame includes a front sealed region in the front end portion thereof, said front sealed region sealing the front sub-lens group in said front sub-lens group frame; and

wherein said rear sub-lens group frame includes a rear sealed region in the rear end portion thereof, said rear sealed region sealing the rear sub-lens group in said rear sub-lens group frame.

18. (New) The lens barrel according to claim 16, said direct engagement being between respective opposing surfaces of said front sub-lens group frame and said rear sub-

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lens group frame, the lens barrel further comprising:

a pair of follower engaging recesses formed on one of said opposing surfaces; and
at least one follower projection formed on the remaining one of the opposing surfaces;
wherein a mutually close determined distance is defined via engagement of said
follower projection and one of said pair of follower engaging recesses, and a mutually distant
determined distance is defined via engagement of said follower projection and the remaining
one of said pair of follower engaging recesses.

19. (New) The lens barrel according to claim 16, wherein said front sub-lens group
frame and said rear sub-lens group frame are rotatable relative to each other; and

wherein said lens frame shift mechanism includes a shift cam mechanism, provided
to said respective opposing surfaces of said front sub-lens group frame and said rear sub-lens
group frame, that moves said front and rear sub-lens group frames between a mutually distant
determined distance and a mutually close determined distance in accordance with relative
rotation of said front and rear sub-lens group frames.

20. (New) The lens barrel according to claim 19, wherein said shift cam mechanism
includes:

a shift cam surface provided on one of said respective opposing surfaces, said shift
cam surface being inclined with respect to a circumferential direction thereof; and

a follower projection provided on the remaining one of said respective opposing
surfaces, engaging with said shift cam surface.

21. (New) The lens barrel according to claim 20, wherein a pair of follower engaging
recesses are formed at opposite ends of each of said shift cam surfaces, wherein said follower
projection engages with one of said follower engaging recesses when said front and rear sub-

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lens group frames are at said mutually close determined distance and in said mutually distant determined distance.

22. (New) The lens barrel according to claim 16, further comprising:

a lens frame shift mechanism for causing said front sub-lens group frame and said rear sub-lens group frame to move relative to each other between a mutually close determined distance and a mutually distant determined distance; and

a focusing mechanism for moving said front and rear sub-lens group frames together in the optical axis direction, while maintaining one of said mutually close determined distance and in said mutually distant determined distance.

23. (New) The lens barrel according to claim 16, wherein said front and rear sub-lens groups form one of a plurality of variable lens groups of a zoom lens system that are moved in the optical axis direction during zooming, said front and rear sub-lens groups serving as a focusing lens group when at a mutually close determined distance and at a mutually distant determined distance.